Citation:

Skinner JD, Bounds W, Carruth BR, Ziegler P. Longitudinal calcium intake is negatively related to children's body fat indexes. *J Am Diet Assoc*. 2003 Dec;103(12):1626-31.

PubMed ID: 14647089

Study Design:

Cohort study (longitudinal, prospective)

Class:

B - Click here for explanation of classification scheme.

Research Design and Implementation Rating:

POSITIVE: See Research Design and Implementation Criteria Checklist below.

Research Purpose:

This study examines

- how children's body fat indexes change between ages 6 and 8 years,
- how children's dietary calcium intakes change between ages 2 and 8,
- what variables are related to children's dietary calcium intake,
- whether previously reported inverse dietary calcium/body fat relationship show at age 6 still exists at age 8 and
- what other variables predicted body fat.

Inclusion Criteria:

8-year-old children of mothers who chose to have a dual-energy x-ray absoptiometry (DEXA) scans for themselves and their children. Children and mothers were a subset of a larger longitudinal study.

Exclusion Criteria:

Mother's pregnancy excluded her from DEXA scan administration.

Description of Study Protocol:

Design

Children were followed from ages 2 months to 8 years with in-home interviews collected at 20 data collection points. Mothers were given 24-hour recall and 2 days of food records for each child and for themselves. Mothers estimated the daily time their child spent in sedentary activities (TV/video viewing, playing computer games, listening to audiotapes, non-active games/activities).

Statistical Analysis

Correlation statistics (Pearson r) calculated among variables BMI, %BF, and kg BF at 8 years, between DEXA measurements at 6 and 8 years, and between mother/child pairs for %BF and kg BF.

PROC RSQUARE and stepwise regression used to predict children's calcium intake.

Data Collection Summary:

Timing of Measurements

Children were followed from ages 2 months to 8 years with in-home interviews collected at 20 data collection points.

Dependent Variables

%BF and g BF

Independent Variables

Breast feeding duration, age of introduction to cereal, child's mean, dietary variety score from ages 3.5 to 7 years, sedentary activity time of the child, number of foods the child liked from a list of 196 commonly eaten foods as reported by mothers, the number of foods liked by mothers (same food list), whether the mother perceived the child as a picky eater, child's carbonated beverage intake at 8 years, child's intake of beverages other than milk, 100% juices, carbonated drinks and water at age 8 years, mothers calcium intake, child's previous milk intake (age 2 to 7 years).

Potential Independent Variables

Mother's % BF or g BF; mother's BMI; father's BMI; child's gender; child's weighted sedentary activity hours/day; child's daily longitudinal dietary intakes for calcium, energy, protein, carbohydrate, fat, saturated fat, polyunsaturated fat, and monounsaturated fat

Description of Actual Data Sample:

Initial N: 70 child/mother pairs

Attrition (final N): 52 child/mother pairs (25 boys, 27 girls)

Age: 8 years old

Ethnicity: White

SES: Middle and upperclass

Location: Tennessee

Summary of Results:

Mean age of children 8.1±0.1 years. Mean age of mothers 38.0±3.6 years.

Percent body fat increased by 4.8% in boys and 5.4% in girls. Body fat indexes were significantly correlated between mothers and daughters (r-0.58; p=0.002(%BF); r=0.59, p=0.001(g BF))

Percentages of energy were about 14%, 32%, 56% from protein, fat, and carbohydrate and did not differ significantly by gender. Boys' diets average approximately 175 kcal more per day and approximately 100 mg more calcium compared with girls' intakes.

Differences in intake between genders were only significantly at age 5 years. Boys' mean intakes met the adequate intake (AI) amount at each time, girls' intakes were slightly less than 800 mg/day at 2 of 6 of the interview times from ages 4 to 8 years. Correlations tracking boys' calcium intakes over time were significant for 4 of the 10 comparisons between interview times whereas girls' calcium intakes were significantly correlated for 9 of the 10 comparisons.

Best model predicting children's calcium intake included 3 variables:

1. mean dietary variety score (positively related), calcium intake,
2. carbonated beverage intake at 8 years, and
3. children's intake of "other" beverages (negatively related).

Children averages 2.9±1.7 hours per day in sedentary activities (range was 0.8 to 8.8 hours per day).

Dietary calcium and polyunsaturated fat were negatively related to children's body fat. Positive predictors of body fat were total fat, saturated fat, sedentary activity, female gender, mothers' percent body fat, fathers BMI. Longitudinal dietary calcium explained 4.5% to 9.0% o the variability in body fat among these children.

Saturated fat, monounsaturated fat, protein, and carbohydrates were examined but not found to be significantly associated with children's body fat.

Author Conclusion:

The similarities of the children's mean calcium intakes over time and the significant correlations among age periods highlight the importance of establishing food habits early in a child's life. The negative relationship between dietary calcium and body fat (4.5% to 9.0% of the variance) indicates that the children could reduce their body fat by 0.4% if they increased their calcium intake with one 8-oz serving of a non-fat milk or yogurt. This study also supports the role of physical activity in controlling childhood obesity. Children averaged more than 20 hours per week in sedentary activity, which is especially significant considering that most of the interviews over 7 years were conducted in June, July, and August, when school was not in session.

Reviewer Comments:

Strengths*:*

- *Longitudinal design.*

Limitations:

- *None of the predictive models for percent body fat contained energy as a covariate.*
- *Also, should have examined the influence of growth rates on the relationship between*

calcium and dairy foods and body fat.
- *No controlling.*

Research Design and Implementation Criteria Checklist: Primary Research

Relevance Questions		
1.	Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (Not Applicable for some epidemiological studies)	N/A
2.	Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	Yes
3.	Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to nutrition or dietetics practice?	Yes
4.	Is the intervention or procedure feasible? (NA for some epidemiological studies)	N/A

Validity Questions		
1.	**Was the research question clearly stated?**	Yes
1.1.	Was (were) the specific intervention(s) or procedure(s) [independent variable(s)] identified?	Yes
1.2.	Was (were) the outcome(s) [dependent variable(s)] clearly indicated?	Yes
1.3.	Were the target population and setting specified?	Yes
2.	**Was the selection of study subjects/patients free from bias?**	Yes
2.1.	Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	Yes
2.2.	Were criteria applied equally to all study groups?	Yes
2.3.	Were health, demographics, and other characteristics of subjects described?	Yes
2.4.	Were the subjects/patients a representative sample of the relevant population?	Yes
3.	**Were study groups comparable?**	Yes
3.1.	Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	N/A
3.2.	Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	Yes

3.3.	Were concurrent controls used? (Concurrent preferred over historical controls.)	Yes
3.4.	If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	Yes
3.5.	If case control or cross-sectional study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	N/A
3.6.	If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	N/A
4.	**Was method of handling withdrawals described?**	Yes
4.1.	Were follow-up methods described and the same for all groups?	Yes
4.2.	Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	Yes
4.3.	Were all enrolled subjects/patients (in the original sample) accounted for?	Yes
4.4.	Were reasons for withdrawals similar across groups?	Yes
4.5.	If diagnostic test, was decision to perform reference test not dependent on results of test under study?	N/A
5.	**Was blinding used to prevent introduction of bias?**	???
5.1.	In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	N/A
5.2.	Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	???
5.3.	In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	???
5.4.	In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	N/A
5.5.	In diagnostic study, were test results blinded to patient history and other test results?	N/A
6.	**Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were interveningfactors described?**	Yes
6.1.	In RCT or other intervention trial, were protocols described for all regimens studied?	N/A

6.2.	In observational study, were interventions, study settings, and clinicians/provider described?	N/A
6.3.	Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	Yes
6.4.	Was the amount of exposure and, if relevant, subject/patient compliance measured?	Yes
6.5.	Were co-interventions (e.g., ancillary treatments, other therapies) described?	N/A
6.6.	Were extra or unplanned treatments described?	N/A
6.7.	Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	N/A
6.8.	In diagnostic study, were details of test administration and replication sufficient?	N/A
7.	**Were outcomes clearly defined and the measurements valid and reliable?**	Yes
7.1.	Were primary and secondary endpoints described and relevant to the question?	Yes
7.2.	Were nutrition measures appropriate to question and outcomes of concern?	Yes
7.3.	Was the period of follow-up long enough for important outcome(s) to occur?	Yes
7.4.	Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	Yes
7.5.	Was the measurement of effect at an appropriate level of precision?	Yes
7.6.	Were other factors accounted for (measured) that could affect outcomes?	Yes
7.7.	Were the measurements conducted consistently across groups?	Yes
8.	**Was the statistical analysis appropriate for the study design and type of outcome indicators?**	Yes
8.1.	Were statistical analyses adequately described and the results reported appropriately?	Yes
8.2.	Were correct statistical tests used and assumptions of test not violated?	Yes
8.3.	Were statistics reported with levels of significance and/or confidence intervals?	Yes
8.4.	Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	N/A
8.5.	Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	Yes

	8.6.	Was clinical significance as well as statistical significance reported?	Yes
	8.7.	If negative findings, was a power calculation reported to address type 2 error?	N/A
9.	**Are conclusions supported by results with biases and limitations taken into consideration?**		Yes
	9.1.	Is there a discussion of findings?	Yes
	9.2.	Are biases and study limitations identified and discussed?	Yes
10.	**Is bias due to study's funding or sponsorship unlikely?**		???
	10.1.	Were sources of funding and investigators' affiliations described?	Yes
	10.2.	Was the study free from apparent conflict of interest?	???